

## BURNING AND MELTING SYSTEM OF INFECTION TRASH

### BACKGROUND OF THE INVENTION

#### 1. Field of the Invention

The present invention relates to a burning and melting system of infection trash, more particularly, to a burning and melting system of infection trash, in which the infectious trash is directly burned and fired without going through sterilizing and crushing processes.

#### 2. Discussion of the Background Art

Infectious trash (or infection trash) means the materials produced by hospitals, health-care organizations or medical testing organizations, for example, body tissues, extracts, or absorbent cottons, which can harm human bodies.

Medical trash is the typical example of the infectious trash. Unlike other garbage, the infectious trash contains infectious agents like animal carcasses, blood and body fluids of patients, glasses, needles, bandages, gauzes and so forth.

In the past, the infectious trash from hospitals was usually packed and tightly sealed up in special containers for the trash and collected by exclusive trash trucks for disposal in landfills. Generally the infectious trash was sterilized and crushed before it was put into the burning apparatus. Then the trash was burned by a burner and residues were buried.

However, when medical trash is burned in the burning apparatus of the related art, incineration procedures produce toxic fumes like dioxin and nitrogen oxides, and a secondary contamination was likely to occur due to unburned solid trash.

To reduce dioxin levels, the trash was burned at a very high temperature and cooled speedily. But when the trash was burned at 950°C or higher to the air, nitrogen in the air reacts with oxygen, producing nitrogen oxides, and it was very costly to remove the nitrogen oxides.

On the other hand, the unburned solid trash, namely residues from incineration, were and are still buried in landfills, but environmental hazards because of the toxic materials therein limited the use of incineration for medical trash disposal.

Alternative methods, e.g. melting and slagging the residues, have been used.

When residues of the infectious trash are melted and slagged, metals inside the residues and dioxin are glassified. As a result, the possibility of the secondary

contamination due to the residues can be greatly reduced.

Fig. 1 is a diagram illustrating infectious trash treatment system using a burning apparatus and a melting apparatus of the related art.

Referring to Fig. 1, described now is how the infectious trash is treated in the burning and melting apparatuses of the related art.

Once the infectious trash 1 like animal carcasses, blood and body fluids of patients, glasses, needles, bandages or gauzes is collected, it is first sterilized or disinfected and then crushed up before being put in the burning apparatus. This is because to improve incineration efficiency.

After going through the sterilizing and crushing processes, the infectious trash is put into a burning apparatus 2 and burned in a burner 3. In general, the temperature inside of the burner 3 ranges from 850oC to 900oC.

Unfortunately all the trash 1 is not always completely burned through the burner 3. In fact, toxic materials produced by incineration of the trash 1, including unburned trash or residues from incineration often cause serious environmental contamination.

Therefore, to prevent further air contamination, it is absolutely necessary to limit the amount of toxic fumes and dust from being discharged to the air.

Byproducts of incineration of the infectious trash include bottom ash 6 and fly ash 5. These two will be referred to as incineration ash, or burned residues 7.

However, these burned residues 7 are also environmental contaminants, so before they are discharged from the burner 3, a special treatment should be performed thereon.

For example, the bottom ash 6 includes wet ash being collected through water-bag process and dry ash. As a pretreatment, the ash is crushed and undergoes magnetic separation to remove magnetic materials from the ash, e.g. iron with high melting point in this case. Later the wet ash is put into a drier and mixed with the dry ash to form main material.

The fly ash 5, on the other hand, is collected by a collector (not shown), e.g. a bag filter, where off gas from the burner 3 passes through before it is discharge to the air.

Usually the fly ash 5 includes much of heavy metals with low boiling points or salts. When the fly ash 5 is heated at a high temperature, most of the content is fumed in the gas but the salts give serious damages on refractories of the burner. This explains why the fly ash 5 is rarely treated alone, and usually mixed with the main ash for melting.

After the burned residues 7 go through the pretreatment, it is melted through a melter 8 and made into slag 9.

Once the burned residues 7 are melted and slagged, metals included in the burned residues 7 are removed, and since its outside surface is coated with a glass film, there is little possibility to cause the secondary environmental contamination caused by the burned residues 7.

To melt and to coagulate the surface of the ash, a burner type melter that heats the surface of the ash and discharges the molten ash in the form of the slag 9 is usually used. As for the burner type ash melter, there are rotating circular type surface melters and inclined reverberatory furnace-shaped fixed surface melters.

Besides the above, there is a melting apparatus 8 using plasma heating. This type of the melting apparatus has a plasma torch inside the melter, and a plasma arc irradiated from the top end of the plasma torch melts the burned residues.

However, despite the sterilizing and crushing processes being performed on the infectious trash prior to the incineration process, the above infectious trash treatment methods of the related art are not completely immune to the secondary environmental contamination during the sterilizing and crushing processes. Even when the infectious trash was sterilized or disinfected, crushed, burned and melted, toxic gas is not still perfectly removed from the trash.

Moreover, the burning and melting apparatuses of the related art have drawbacks primarily because they are separate not combined. In other words, the burning and melting processes are performed in separate apparatuses. Thus the burned residues discharged from the burning apparatus had to be delivered to the melting apparatus through a special transportation means. To deliver the high temperature burned residues (higher than 400°C in this case), the water-bag process should be done. In so doing, trashwater or stink is naturally produced.

#### SUMMARY OF THE INVENTION

An object of the invention is to solve at least the above problems and/or disadvantages and to provide at least the advantages described hereinafter.

Accordingly, one object of the present invention is to solve the foregoing problems by providing a burning and melting system of infection trash, in which

the infectious trash (or infection trash) does not go through a sterilizing and crushing process as in the related art but is burned and melted under Brown's gas, and toxic fumes generated from the burning and melting processes are continuously circulated inside the system until they get completely burned, eventually purifying the toxic fumes.

The foregoing and other objects and advantages are realized by providing a burning/melting system of infection trash, which includes a trash feeding pipe to which infectious trash is supplied; burners for burning the infectious trash supplied through the trash feeding pipe by using Brown's gas, when the amount of the infection trash reaches a predetermined level; a melter for melting burned residues and glasses discharged from the burners thereto by using the Brown's gas; a post-combustion chamber for combusting toxic fumes produced from the burners and the melter by using the Brown's gas; a gas analyzing line for analyzing the toxic fumes having been combusted in the post-combustion chamber and if the amount of toxic elements contained in the combusted fumes exceeds a standard level, for feeding the combusted fumes back into the burners; and a gas outlet for discharging the combusted fumes to the outside if the amount of toxic elements contained therein is less than the standard level.

In an exemplary embodiment, the burners are comprised of a rotating burner for burning the infectious trash by rotating the entire burner; and an auxiliary burner for burning the infection trash again, the infection trash having been already burned in the rotating burner.

In an exemplary embodiment, the rotating burner includes a transferring means being installed at an inside of the burner, for transferring only the infection trash under a predetermined volume to the auxiliary burner, and the auxiliary burner comprises a discharging means being installed at a lower portion of the burner, for discharging only the burning trash under a predetermined volume.

In an exemplary embodiment, the burned residues discharged from the auxiliary burner are fed to a melter through a screw conveyor.

In an exemplary embodiment, the infectious trash fed to the trash feeding pipe does not go through a sterilizing and crushing process.

In an exemplary embodiment, the system further includes a gas feeding line for feeding off gas from the burners directly into the melter.

In an exemplary embodiment, the melter includes an exit at a lower portion of the melter, for discharging a slag, the slag being formed of molten burned residues and glasses.

In an exemplary embodiment, the melter and the post-combustion chamber include at least one burner using Brown's gas being disposed on one side, respectively.

5 In an exemplary embodiment, the post-combustion chamber further includes at least one bowl filled with glasses.

The burning and melting system for treatment of infectious trash of the present invention can be advantageously used for treating the infectious trash more effectively and sanitarily by burning the infectious trash and melting immediately and continuously circulating the infectious trash until toxic fumes generated from  
10 the burning process on the infectious trash are completely removed, and for reducing environmental contamination caused by removing stink or harmful fumes from the infectious trash at 1300°C or higher.

Additional advantages, objects, and features of the invention will be set forth in part in the description which follows and in part will become apparent to those  
15 having ordinary skill in the art upon examination of the following or may be learned from practice of the invention. The objects and advantages of the invention may be realized and attained as particularly pointed out in the appended claims.

#### 20 BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be described in detail with reference to the following drawings in which like reference numerals refer to like elements wherein:

Fig. 1 is a diagram illustrating infectious trash treatment system using a burning apparatus and a melting apparatus of the related art; and

25 Fig. 2 is a diagram illustrating a burning and melting system of infection trash according to one embodiment of the present invention.

#### DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

The following detailed description will present a burning and melting system of  
30 infection trash according to a preferred embodiment of the invention in reference to the accompanying drawings.

Fig. 2 is a diagram illustrating the burning and melting system of infection trash in accordance with the present invention.

Referring to Fig. 2, the burning and melting system of infection trash includes a trash feeding pipe 11 to which the infectious trash is supplied, burners 14 and 14' for burning the infectious trash supplied through the trash feeding pipe when the amount of the trash reaches a predetermined level, a melter 20 for melting burned residues and glasses discharged from the burners 14 and 14' thereto by using Brown's gas, a post-combustion chamber 22 for combusting toxic fumes produced from the burners 14 and 14' and the melter 20 by using Brown's gas, a gas analyzing line 24 for analyzing the toxic fumes having been combusted in the post-combustion chamber 22 and if the amount of toxic elements contained in the combusted fumes exceeds a standard level, for feeding the combusted fumes back into the burner 14, and a gas outlet 25 for discharging the combusted fumes to the outside if the amount of toxic elements contained therein is less than the standard level.

Here, the infectious trash 10 to be supplied to the trash feeding pipe 11 has not gone through the sterilizing and crushing processes. Instead, the infectious trash 10 in this case is the original, infected material that had been packed at hospitals into special type of containers exclusively for the trash, and delivered through trash trucks exclusively for the trash.

In the past, the original infectious trash 10 used to be disinfected and crushed prior to the incineration process, to improve incineration efficiency. However, environmental contamination problems were often caused during those processes. Hence, in the present invention, the infectious trash was directly put into the burner, without being sterilized and crushed.

According to the preferred embodiment of the present invention, the trash feeding pipe 11 includes a lifter 12 for lifting boxes filled with the infectious trash 10, and a feeder 13 for feeding the infectious trash provided from the lifter 12 to the burner.

To be short, the infectious trash 10 is fed to the burners 14 and 14' through the trash feeding pipe 11 in its original form, i.e. being packed and sealed in the exclusive containers. When the amount of the infectious trash reaches a predetermined level, the burners 14 and 14' start burning the trash.

Here, two types of burners are used. One burner 14 is a rotating burner that burns the infectious trash by rotating, and the other burner 14' is an auxiliary burner for burning the trash for the second time that had been already burned in the rotating burner 14.

In other words, the infectious trash provided through the trash feeding pipe 11 is primarily burned in the rotating burner 14, and when the total volume of the infectious trash is reduced below the predetermined level, the trash is sent to the auxiliary burner 14' for another incineration.

5 As discussed before, the infectious trash 10 in this exemplary embodiment does not undergo the crushing process as in the related art. Rather, it is fed to the rotating burner 14 in its original form, being packed and sealed in the exclusive containers at hospitals. Normally, the primary incineration at the rotating burner 14 does not get started until approximately 2/3 of its volume is filled with the  
10 infectious trash.

That is, when the infectious trash is fed into the rotating burner 14 up to 2/3 of the total volume of the burner, a brown's gas burner (not shown) ignites the trash and the rotating burner 14 starts burning the infectious trash, rotating at the same time.

15 Moreover, the rotating burner includes a transferring means 29 for transferring only the trash under a certain volume to the auxiliary burner 14'. The auxiliary burner includes a discharging means 29' for discharging only the incineration trash under a certain volume at its bottom part.

This is because the infectious trash is directly fed into the burners 14 and 14' without being crushed and because bulky burned trash or the burned residues  
20 should not be put into the melter.

Here, the transferring means 29 installed in the rotating burner, to transfer only the trash under a certain volume to the auxiliary burner 14', has the shape of a web, and its inside wall is based on a water cooled system to be able to stand  
25 high temperatures inside the burner 14' and its outside wall is coated with ceramic to be able to stand high temperatures of the burner 14' and to be protected from corrosion due to corrosive gases.

More specifically, because the rotating burner 14 is tilted at a certain degree, the trash inside the burner 14 goes down because of gravity, and the  
30 web-structured transferring means 29 installed at the bottom part of the rotating burner 14 filters or transfers only the trash under a certain volume to the auxiliary burner 14', the trash being small enough to be able to pass through the spaces in the web structure.

Similarly, the discharging means 29' installed at the bottom part of the auxiliary  
35 burner 14', to discharge only the incineration trash under a certain volume has the shape of a web only with the difference that its spaces in the web structure are narrower than those of the transferring means 29. This is because it is

better to make the twice-burned residues into smaller volumes before discharging them.

The web-shaped structure has been introduced only as an embodiment, so any structure, as long as it can filter or pass through the burned residues under a certain size (volume), can be used.

However, the infectious trash is not completely burned by the rotating burner 14 and the auxiliary burner 14'. Its complete incineration comes only after it undergoes the melting process in the melter 20 and the combustion process in the combustion chamber 22 and finally keeps circulating until off gas meets or below the off-gas discharge standard.

On the top of the rotating burner 14 is a gas feeding line 15 through which the off gas from the burners 14 and 14' is sent directly to the melter 20.

The gas feeding line 15 serves to burn toxic fumes including dioxin produced from the infectious trash during the burning processes in the burners 14 and 14' more completely. The off gas from the burners 14 and 14' is sent to the melter 20 through the gas feeding line 15 and combusted in the melter 20 at a higher temperature than that of the burners 14 and 14'.

The gas feeding line 15 includes a dehumidifier 17 for removing moisture or water in the gas, and a fan 18 for guiding the off gas from the burners 14 and 14' to be discharged from the melter 20. Additionally, a backfire preventer 19 is installed at the connecting point of the melter 20, to prevent the frame ignited by the Brown's gas from being backfired.

Moreover, the burners 14 and 14' can include an air supplier 16 for providing air to the burners 14 and 14', if needed to incinerate the infectious trash. The air supplier is used especially when the ignition means of the burners 14 and 14' is an oxygen gas burner.

As aforementioned, when the infectious trash is burned in the burners 14 and 14', residues are produced. The burned residues and glass are fed to the melter 20 and slagged.

The burned residues are discharged through the lower end portion of the auxiliary burner 14' and the discharged burned residues are delivered by a transportation means like a screw conveyor 28 and eventually fed to the melter 20 together with glass.

The screw conveyor 28 works best especially when the delivery distance is not too long, or when the delivery path is not too steep, or when the amount of trash to be delivered is appropriate, or when the trash to be delivered is particulate and not abradable.



The screw conveyor has several merits, compared to other types of conveyors, in that its price is competitive, and it prevents the delivery materials from being dusted simply by attaching a cover on the top, and it can be effectively used for delivering massive materials as long as the materials are not larger than the screw's diameter and pitch.

At least one burner (not shown) using Brown's gas is installed at one side of the melter 20. This type of burner using Brown's gas does not explode the materials as in the related art but implodes the material, generating at least 1300oC of heat.

The above phenomenon occurs because the Brown's gas, unlike other general gases, implodes during the combustion process and does not get exploded. Rather, it is focused as gathering flames inward and evacuates its surrounds.

As a result, combusting Brown's gas, it becomes possible to generate extremely high heats that can sublime even tungsten that is known to have a very high melting point. In addition, the burner using Brown's gas is very energy-effective because its (heat) rays are not exposed to the outside, and thus there is no energy loss due to radiation. Further, because the burner contains oxygen, there is no need to supply oxygen additionally during the combustion process. Lastly, water is the only product of the combustion process using this type of burner, so users do not have to worry about air pollution at all.

As such, the burned residues and glass fed to the melter 20 are melted together, and the molten burned residues are slagged. This consequently glassifies residual metals and dioxins in the burned residues, leaving little possibility to cause environmental contamination due to the burned residues. The slag is discharged to the outside through an exit 21 formed on the lower portion of the melter 20.

As discussed before, the off gas from the burners 14 and 14' is sent to the melter 20 through the gas feeding line 15, and combusted in the melter 20 at a high temperature. In this manner, some toxic fumes like dioxin produced in the burners 14 and 14' are primarily removed.

However, since the toxic fumes are not completely removed by the melter 20, a post-combustion chamber 22 is additionally installed to combust the toxic fumes again at a very high temperature.

The post-combustion chamber 22 is connected to the melter 20, and includes at least one burner (not shown) using Brown's gas at one side of the chamber. As described before, this type of burner using Brown's gas can generate an

extremely high heat energy.

Also, at least one bowl (not shown) with glass therein is disposed inside the combustion chamber 22. The burner using Brown's gas serves to raise the temperature inside the combustion chamber 22, and the glass in the bowl(s) is melted due to the extremely high temperature inside the chamber. When the glass is melted, it also generates heat and this heat is used to increase the temperature inside the combustion chamber 22 even higher.

The off gas from the burners 14 and 14' and melter 20 is combusted for the second time in the combustion chamber 22, and as a result, toxic elements therein are greatly reduced. This combusted gas in the combustion chamber 22 is not immediately discharged to the outside. Instead, it is subjected to a test by a gas analyzer 23 to find out whether the gas contains toxic elements more than the standard level.

If it turns out that the gas has toxic elements more than the standard level, the gas is sent back to the burners 14 and 14' via the gas analyzing line 24, and the gas circulates the burners 14 and 14', the melter 20, and the combustion chamber 22 until the toxic elements content falls below the standard level.

When the amount of the toxic elements contained in the gas is less than the standard level, the gas is discharged to the outside through the outlet 25. At this time, an electric collector 26 for removing toxic dust and a wet scrubber 27 for removing chlorine are installed at the end portion of the gas outlet 25.

In conclusion, the burning and melting system of infection trash of the present invention can be advantageously used for treating the infectious trash more effectively and sanitarily and for reducing environmental contamination caused by stink or harmful fumes from the infectious trash, by burning the infectious trash and melting immediately and continuously circulating the infectious trash until toxic fumes in the burned residues are completely combusted.

While the invention has been shown and described with reference to certain preferred embodiments thereof, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the invention as defined by the appended claims.

The foregoing embodiments and advantages are merely exemplary and are not to be construed as limiting the present invention. The present teaching can be readily applied to other types of apparatuses. The description of the present invention is intended to be illustrative, and not to limit the scope of the claims. Many alternatives, modifications, and variations will be apparent to those skilled in the art. In the claims, means-plus-function clauses are intended to cover the

structures described herein as performing the recited function and not only structural equivalents but also equivalent structures.